

Having described the invention, the following is claimed:

1. An apparatus for use in positioning a suture anchor relative to body tissue, said apparatus comprising a tubular member through which the suture anchor is movable and a pusher member which is at least partially disposed in and is movable relative to the tubular member to move the anchor relative to the tubular member, said tubular member having an end portion which is operable between a closed condition blocking movement of the anchor through the end portion of the tubular member into the body tissue and an open condition in which the end portion of the tubular member is ineffective to block movement of the anchor into the body tissue.

2. An apparatus as set forth in claim 1 wherein said end portion of said tubular member has surface means for engaging the anchor to operate said end portion of said tubular member from the closed condition to the open condition under the influence of force transmitted from the anchor to said end portion of said tubular member.

3. An apparatus as set forth in claim 1 wherein said end portion of said tubular member is resiliently expandable from the closed condition to the open condition under the influence of force applied against an inner side

of said tubular member to enable the anchor to move through the end portion of the tubular member into body tissue.

4. An apparatus as set forth in claim 1 wherein said end portion of said tubular member includes surface means for piercing body tissue when said end portion of said tubular member is in the closed condition.

5. An apparatus as set forth in claim 1 wherein said end portion of said tubular member includes a plurality of segments, each of said segments having an inner surface, an outer surface and a plurality of side surfaces which extend between said inner and outer surfaces, said side surfaces on each of said segments being disposed adjacent to side surfaces on adjacent segments when said end portion of said tubular member is in the closed condition, said outer surfaces on said segments cooperating to form a pointed end portion of said tubular member when said end portion of said tubular member is in the closed condition.

6. An apparatus as set forth in claim 1 wherein said tubular member has a body portion which is connected with said end portion, said body portion and said end portion of said tubular member cooperating to define a passage which extends through said body portion and said end portion when said end portion is in the open condition, said end portion of said tubular member being expandable to increase the

cross-sectional size of a portion of the passage in said end portion of said tubular member upon operation of said end portion of said tubular member from the closed condition to the open condition.

7. An apparatus as set forth in claim 6 wherein said end portion of said tubular member includes a plurality of sections which are disposed adjacent to each other and at least partially block the portion of the passage in said end portion of said tubular member when said end portion of said tubular member is in the closed condition, said plurality of sections being movable relative to each other upon operation of said end portion of said tubular member from the closed condition to the open condition.

8. An apparatus as set forth in claim 7 wherein said tubular member includes a plurality of wires connected with said plurality of wires connected with said plurality of sections, said plurality of sections being resiliently deflectable to effect relative movement between said plurality of sections and to effect relative movement between said plurality of wires.

9. An apparatus as set forth in claim 6 wherein said tubular member includes a sheath and an array of wires which extend along an inner side of said sheath, said array

of wires extend from said body portion of said tubular member into said end portion of said tubular member.

10. An apparatus as set forth in claim 1 wherein said end portion of said tubular member is insertable into body tissue, said end portion of said tubular member having indicia disposed thereon to indicate the depth of insertion of said end portion of said tubular member into body tissue.

11. A method of positioning a suture anchor relative to body tissue, said method comprising the steps of positioning an end portion of a tubular member relative to body tissue with the end portion of the tubular member in a closed condition at least partially blocking a passage in the tubular member, moving a suture anchor along the passage in the tubular member with a suture disposed in engagement with the suture anchor, operating the end portion of the tubular member from the closed condition to an open condition, and moving the suture anchor through the end portion of the tubular member into the body tissue while the end portion of the tubular member is in the open condition.

12. A method as set forth in claim 11 wherein said step of positioning the end portion of the tubular member relative to body tissue with the end portion of the tubular

member in the closed condition includes piercing an imperforate surface on the body tissue with the end portion of the tubular member.

13. A method as set forth in claim 11 wherein said step of operating the end portion of the tubular member from the closed condition to the open condition includes applying force against the end portion of the tubular member with a leading end portion of the suture anchor while moving the suture anchor along the passage in the tubular member.

14. A method as set forth in claim 11 wherein said step of moving the suture anchor through the end portion of the tubular member includes pressing a circular array of surface areas on the inside of the end portion of the tubular member against an exterior surface of the suture anchor.

15. A method as set forth in claim 11 wherein said step of operating the end portion of the tubular member from the closed condition to the open condition includes moving portions of segments of the end portion of the tubular member apart.

16. A method as set forth in claim 11 wherein said step of operating the end portion of the tubular member

10078030.004000

from the closed condition to the open condition includes sliding the suture anchor along outer side surfaces of a plurality of wires disposed in the end portion of the tubular member.

17. A method as set forth in claim 11 wherein said step of operating the end portion of the tubular member from the closed condition to the open condition includes resiliently expanding the end portion of the tubular member under the influence of force applied against the end portion of the tubular member by the anchor.

18. A method as set forth in claim 11 wherein said step of positioning an end portion of the tubular member relative to body tissue includes moving the end portion of the tubular member into body tissue until indicia on the end portion of the tubular member indicates that the tubular member has been inserted a predetermined distance into the body tissue.

19. A method as set forth in claim 11 wherein said step of positioning an end portion of the tubular member relative to body tissue includes moving the end portion of the tubular member into body tissue and covering indicia corresponding to the depth of movement of the tubular member into body tissue with body tissue as the tubular member is moved into the body tissue, and interrupting said

step of moving the end portion of the tubular member into body tissue upon covering of indicia corresponding to a desired depth of insertion of the tubular member into the body tissue.

20. A method of positioning a suture anchor relative to body tissue, said method comprising the steps of providing a suture anchor having a suture disposed in engagement with the suture anchor, providing a tubular member, moving the suture anchor along a passage in the tubular member with the suture disposed in engagement with the suture anchor, expanding at least a portion of the passage in the tubular member while moving the suture anchor along the passage in the tubular member, and moving the suture anchor out of the passage in the tubular member into the body tissue with the suture disposed in engagement with the suture anchor.

21. A method as set forth in claim 20 wherein said step of expanding at least a portion of the passage in the tubular member includes transmitting force from a leading end portion of the suture anchor to the tubular member while moving the suture anchor along the passage in the tubular member and expanding at least a portion of the tubular member under the influence of the force transmitted from the leading end portion of the suture anchor to the tubular member.

22. A method as set forth in claim 20 further including the step of inserting the tubular member into the body tissue by piercing the body tissue with an end portion of the tubular member prior to performing said step of expanding at least a portion of the passage in the tubular member.

23. A method as set forth in claim 20 wherein said step of expanding at least a portion of the passage in the tubular member includes resiliently stretching material which forms at least a portion of the tubular member.

24. A method as set forth in claim 20 wherein said step of expanding at least a portion of the passage in the tubular member includes moving segments of the tubular member from an initial position in which portions of the segments of the tubular member are disposed in engagement with each other to an extended position in which the portions of the segments of the tubular member are spaced apart from each other.

25. A method as set forth in claim 20 wherein said step of providing a tubular member includes providing a tubular member having a sheath which at least partially encloses a plurality of wires which extend along at least a portion of the passage in the tubular member, said step of



moving the suture anchor along a passage in the tubular member includes sliding the suture anchor along the wires.

26. A method as set forth in claim 25 wherein said step of expanding at least a portion of the passage in the tubular member includes expanding at least a portion of the sheath under the influence of force applied against the wires by the suture anchor while sliding the suture anchor along the wires.

27. A method as set forth in claim 20 wherein said step of providing a tubular member includes providing a tubular member having a sheath which at least partially encloses a plurality of wires which extend along at least a portion of the passage in the tubular member, said step of moving the suture anchor along a passage in the tubular member includes applying force against the suture anchor with a pusher member and sliding the pusher member along the wires.

28. A method as set forth in claim 20 wherein said step of moving the suture anchor along a passage in the tubular member is performed with at least a portion of the suture anchor enclosed by an expansion member, said step of expanding at least a portion of the passage in the tubular member includes transmitting force from the expansion member to the tubular member while moving the expansion

member and the suture anchor together along the passage in the tubular member.

29. A method as set forth in claim 20 further including the steps of inserting the tubular member into body tissue, covering indicia on the tubular member with body tissue as the tubular member is inserted into the body tissue, and interrupting said step of inserting the tubular member into body tissue in response to covering of indicia corresponding to a desired depth of insertion of the tubular member into body tissue.

30. A method of positioning a suture anchor relative to body tissue, said method comprising the steps of providing a suture anchor having a suture disposed in engagement with the suture anchor, positioning an end portion of a tubular member having a sheath which encloses a plurality of wires relative to body tissue, and moving the suture anchor through the end portion of the tubular member into the body tissue with the suture engaging the suture anchor, said step of moving the suture anchor through the end portion of the tubular member into the body tissue includes sliding an outer side surface of the suture anchor along side surfaces of the wires.

31. A method as set forth in claim 30 wherein said step of positioning an end portion of a tubular member

having a sheath which encloses a plurality of wires relative to body tissue includes engaging the body tissue with a leading end portion of at least one of the wires and a leading end portion of the sheath and piercing the body tissue with the leading end portion of the one wire and the sheath under the influence of force transmitted through the tubular member.

32. A method as set forth in claim 30 wherein said step of moving the suture anchor through the end portion of the tubular member into the body tissue includes transmitting force from the suture anchor to the side surfaces of the wires and expanding the sheath under the influence of the force transmitted from the suture anchor to the wires.

33. A method as set forth in claim 30 wherein said step of moving the suture anchor through the end portion of the tubular member includes maintaining the outer side surface of the suture anchor in a spaced apart relationship with an inner side surface of the sheath while sliding the suture anchor along side surfaces of the wires.

34. A method as set forth in claim 30 wherein said step of moving the suture anchor through the end portion of the tubular member includes holding longitudinally extending portions of an inner side surface of the sheath

10078030-001902

spaced apart from an outer side surface of the suture anchor as the suture anchor moves through the end portion of the tubular member.

35. A method as set forth in claim 30 further including moving the suture anchor along a main portion of the tubular member connected with the end portion of the tubular member prior to moving the suture anchor through the end portion of the tubular member, at least a portion of said step of moving the suture anchor along a main portion of the tubular member includes engaging side surfaces of portions of the wires with the suture anchor.

36. A method as set forth in claim 35 wherein the main portion of the tubular member has a first cross-sectional area as viewed in a plane extending perpendicular to a longitudinal central axis of the tubular member and the end portion of the tubular member has a second cross-sectional area as viewed in a plane extending perpendicular to a longitudinal central axis of the tubular member, the first cross-sectional area being greater than the second cross-sectional area, said step of moving the suture anchor through the end portion of the tubular member includes increasing the cross-sectional area of the end portion of the tubular member from the second cross-sectional area to a cross-sectional area which is greater than the second cross-sectional area.

37. A method as set forth in claim 30 wherein the tubular member has a main portion with a first cross-sectional area as viewed in a plane extending perpendicular to a longitudinal central axis of the tubular member, the end portion of the tubular member has a cross-sectional area which is smaller than the first cross-sectional area as viewed in a plane extending perpendicular to the longitudinal central axis of the tubular member, and a transition portion of the tubular member has a cross-sectional area which tapers from the first cross-sectional area to the second cross-sectional area, said method further including moving a leading end portion of the suture anchor along the side surfaces of the wires in the transition portion of the tubular member and expanding at least a portion of the transition portion of the tubular member under the influence of force transmitted to the side surfaces of the wires in the transition portion of the tubular member.

38. A method as set forth in claim 30 wherein said step of positioning an end portion of a tubular member relative to body tissue includes inserting the end portion of the tubular member into body tissue, measuring the distance which the end portion of the tubular member is inserted into body tissue during insertion of the end portion of the tubular member into body tissue, and interrupting said step of inserting an end portion of the

tubular member into body tissue in response to measuring of a distance which corresponds to a desired distance of insertion of the tubular member into body tissue.

39. A method as set forth in claim 30 wherein said step of positioning an end portion of a tubular member relative to body tissue includes inserting the end portion of the tubular member into body tissue, covering indicia on the tubular member with body tissue as the tubular member is inserted into the body tissue, and interrupting said step of inserting the tubular member into body tissue in response to covering of indicia corresponding to a desired depth of insertion of the tubular member into body tissue.

40. A method of positioning a suture anchor relative to body tissue, said method comprising the steps of providing a suture anchor which has a passage, providing a suture having a first portion which extends through the passage in the suture anchor and a second portion which extends along an outer side of the suture anchor, providing a tubular member having a sheath with a plurality of wires which extend along an inner side of at least a portion of a passage in the sheath, and moving the anchor along the passage in the sheath, said step of moving the anchor along the passage in the sheath being at least partially performed with the first portion of the suture extending through the passage in the suture anchor and the second

portion of the suture extending along the outer side surface of the suture anchor at a location between adjacent wires of the plurality of wires.

41. A method as set forth in claim 40 wherein said step of moving the suture anchor along the passage in the sheath includes sliding an outer side surface of the suture anchor along side surfaces of the wires.

42. A method as set forth in claim 40 wherein said step of moving the anchor along the passage in the sheath includes applying force against a trailing end portion of the anchor with a pusher member and applying force against the wires with a leading end portion of the anchor to expand the passage in the sheath.

43. A method as set forth in claim 40 further including the steps of inserting at least a portion of the tubular member into body tissue and piercing the body tissue with the tubular member.

44. A method as set forth in claim 43 wherein said step of piercing the body tissue includes engaging the body tissue with a leading end portion of at least one of the wires and a leading end portion of the sheath.

45. A method as set forth in claim 40 further including the steps of inserting at least a portion of the tubular member into body tissue, covering indicia on the tubular member with body tissue as the tubular member is inserted into the body tissue, and interrupting said step of inserting the tubular member into body tissue in response to covering of indicia corresponding to a desired depth of insertion of the tubular member into body tissue.

46. A method of positioning a suture anchor relative to body tissue, said method comprising the steps of providing a tubular sheath having a passage and a plurality of wires which extend along an inner side of the passage, inserting an end portion of the sheath and end portions of the wires into body tissue, and moving a suture anchor through the passage in the sheath into the body tissue with a suture engaging the suture anchor, said step of moving the suture anchor through the passage in the sheath into body tissue includes expanding the sheath by applying force against the wires and transmitting force through the wires to the sheath.

47. A method as set forth in claim 46 wherein said step of expanding the sheath includes increasing a cross-sectional size of at least a portion of the passage in the sheath from a first cross-sectional size in which movement of the anchor through at least the portion of the passage



in the sheath is blocked to a second cross-sectional size in which the anchor can move through the portion of the passage in the sheath.

48. A method as set forth in claim 46 wherein said step of applying force against the wires includes pressing an outer side surface of the suture anchor against the wires.

49. A method as set forth in claim 46 further including the step of at least partially enclosing the suture anchor with an expansion member during movement of the anchor through the passage in the sheath, said step of applying force against the wires includes pressing an outer side surface of the expansion member against the wires.

50. A method as set forth in claim 46 wherein said step of inserting an end portion of the sheath and end portions of the wires into body tissue includes piercing the body tissue to form an opening in the body tissue and moving the end portion of the sheath and end portions of the wires into the opening in the body tissue.

51. A method as set forth in claim 50 wherein said step of piercing the body tissue to form an opening in the body tissue includes cutting body tissue with a leading end portion of the sheath.

52. A method as set forth in claim 50 wherein said step of piercing the body tissue includes engaging the body tissue with a leading end portion of at least one of the wires and a leading end portion of the sheath.

53. A method as set forth in claim 50 wherein said step of piercing the body tissue includes initiating the formation of an opening in an imperforate surface area on the body tissue.

54. A method as set forth in claim 46 wherein said step of inserting an end portion of a tubular sheath into body tissue includes covering indicia on the tubular sheath with body tissue as the tubular sheath is inserted into the body tissue, and interrupting said step of inserting the tubular sheath into body tissue in response to covering of indicia corresponding to a desired depth of insertion of the tubular sheath into body tissue.

55. A method of positioning a suture anchor relative to body tissue, said method comprising the steps of providing a tubular sheath having a passage which extends through the sheath, inserting an end portion of the sheath into body tissue, expanding the end portion of the sheath inserted into the body tissue, said step of expanding the end portion of the sheath includes moving a tubular member into the end portion of the sheath and increasing the

cross-sectional size of the end portion of the sheath from a first cross-sectional size to a second cross-sectional size under the influence of force transmitted from the tubular member to the sheath, and moving a suture anchor through the tubular member into the body tissue while the end portion of the sheath has the second cross-sectional size.

56. A method as set forth in claim 55 wherein said step of inserting an end portion of the sheath into body tissue includes piercing the body tissue with the end portion of the sheath and moving the end portion of the sheath into the body tissue.

57. A method as set forth in claim 55 wherein said step of providing a tubular sheath includes providing a tubular sheath having a plurality of wires disposed in the passage through the sheath, said step of moving a tubular member into the end portion of the sheath includes sliding an outer side surface of the tubular member along outer side surfaces of the wires.

58. A method as set forth in claim 55 wherein said step of increasing the cross-sectional size of the end portion of the sheath from a first cross-sectional size to a second cross-sectional size under the influence of force transmitted from the tubular member to the sheath includes

transmitting force from the tubular member to the outer side surfaces of the wires and transmitting force from the wires to the sheath.

59. A method as set forth in claim 55 wherein said step of inserting an end portion of the sheath into body tissue includes covering indicia on the sheath with body tissue as the sheath is inserted into the body tissue, and interrupting said step of inserting the sheath into body tissue in response to covering of indicia corresponding to a desired depth of insertion of the sheath into body tissue.

60. A method of positioning a suture anchor relative to body tissue, said method comprising the steps of providing a tubular member having indicia on one end portion of said tubular member, inserting the one end portion of the tubular member into body tissue, interrupting said step of inserting the one end portion of the tubular member into the body tissue upon movement into the body tissue of indicia corresponding to a desired depth of insertion of the tubular member, and moving a suture anchor through the tubular member into the body tissue with a suture engaging the suture anchor and with the tubular member extending the desired distance into the body tissue.

61. A method as set forth in claim 60 wherein said step of moving the suture anchor through the tubular member into body tissue includes sliding an outer side surface of the suture anchor along outer side surfaces of a plurality of wires disposed in the tubular member.

62. A method as set forth in claim 60 wherein said step of inserting the one end portion of the tubular member into body tissue includes piercing the body tissue with the one end portion of the tubular member to form an opening in the body tissue and moving the tubular member into the opening in the body tissue.

63. A method as set forth in claim 60 wherein said step of moving the suture anchor through the tubular member into the body tissue includes operating the tubular member from a closed condition in which the tubular member blocks movement of the suture anchor through the tubular member to an open condition in which the tubular member is ineffective to block movement of the suture anchor through the tubular member.

ADD  
a2

10028030-021000